

WHAT IS CLAIMED IS:

1. A method of forming an interlevel dielectric (ILD) layer, comprising the steps of:
forming a polymer sacrificial ILD on a substrate;
forming metallization structures within the polymer sacrificial ILD;
etching back the polymer sacrificial ILD;
non-conformally depositing dielectric material as an ILD layer over the substrate and the metallization structures so as to form air gaps in the ILD layer between at least some of the metallization structures.
2. The method of claim 1, wherein the step of forming metallization structures includes depositing copper within the recesses in the polymer sacrificial ILD.
3. The method of claim 2, wherein the step of forming metallization structures includes forming a metal cap layer on the copper deposited within the recesses.
4. The method of claim 3, wherein the etching back of the polymer sacrificial ILD is performed while the cap layer is exposed to the etching back process, the cap layer preventing etching of the copper.
5. The method of claim 4, wherein the cap layer is Ta.
6. The method of claim 5, wherein the polymer sacrificial ILD is silk.
7. The method of claim 6, wherein the dielectric material of the ILD layer is SiO₂ or SiOF.
8. The method of claim 1, wherein the etching back of the polymer sacrificial ILD is a maskless etching back.
9. The method of claim 1, wherein the etching back of the polymer sacrificial ILD is a self-aligned process.

10. The method of claim 6, wherein the dielectric material of the ILD layer is an ultra low k dielectric layer having a dielectric constant less than 2.5.
11. A method of forming an interconnect structure, comprising the steps of:
 - forming a polymer interlayer dielectric (ILD) layer on a substrate;
 - forming metal lines within the polymer ILD layer, the metal lines being capped with a cap layer;
 - etching back the polymer ILD layer; and
 - forming a second ILD layer on the substrate.
12. The method of claim 11, wherein the step of forming a second ILD layer includes non-conformally depositing dielectric material over the metal lines and the substrate, the non-conformally depositing forming air gaps in the dielectric material between at least some of the metal lines.
13. The method of claim 12, wherein the metal lines comprise copper and the cap layer comprises tantalum.
14. The method of claim 11, wherein the step of forming a second ILD layer includes despositing ultra low k dielectric material on the substrate and between the metal lines.
15. The method of claim 14, wherein the metal lines comprise copper and the cap layer comprises tantalum.
16. The method of claim 11, wherein the etching back of the polymer ILD layer is a maskless etching, with a top surface of the cap layer and the polymer ILD layer being free of mask material.
17. The method of claim 16, wherein the metal lines comprise copper and the cap layer comprises tantalum.